INDOOR AIR QUALITY ASSESSMENT

Fitchburg District Court
Fitchburg Juvenile Court
100 Elm Street
Fitchburg, Massachusetts

Prepared by:
Massachusetts Department of Public Health
Bureau of Environmental Health
Indoor Air Quality Program
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Background

Building:	Fitchburg District Court (FDC), Juvenile Court (FJC) and Probation Office
Address:	100 Elm Street basement, Fitchburg, MA
Assessment Requested by:	Steven McKeown. 1st Assistant Chief Probation Office, Fitchburg District Court Probation Office
Reason for Request:	General indoor air quality (IAQ) and allergy concerns
Date of Assessment:	November 8, 2019
Massachusetts Department of Public Health/Bureau of Environmental Health (MDPH/BEH) Staff Conducting Assessment:	Mike Feeney, Director, IAQ Program
Building Description:	Originally constructed as a US Post Office, converted into use as a courthouse in the 1970s.
Building Population:	The courthouse has an employee population of approximately 90 and 100-200 visitors on a daily basis.
Windows:	Openable in some areas

INTRODUCTION

Over the summer of 2019, the basement level of the FDC, which contains the FJC and Probation Office, experienced a flood that wet a significant section of the occupied space. As reported by court officials, wet materials were freeze-dried off site and drying activities in the basement were implemented.

METHODS

Please refer to the IAQ Manual for methods, sampling procedures, and interpretation of results (MDPH, 2015).

IAQ Testing Results

The following is a summary of indoor air testing results (Table 1).

- ***Carbon dioxide levels*** were below the MDPH recommendation of 800 parts per million (ppm) in all areas tested, indicating adequate fresh air in the space. It should be noted some areas had low occupancy during this assessment which can reduce carbon dioxide levels.
- ***Temperature*** was within the MDPH recommended range of 70°F to 78°F in all areas tested.
- ***Relative humidity*** was below the MDPH recommended range of 40% to 60% in all areas tested. Low relative humidity is common in the Northeast during the heating season.
- ***Carbon monoxide*** levels were non-detectable in all indoor areas tested.
- ***Fine particulate matter (PM2.5)*** concentrations measured were below the National Ambient Air Quality Standard (NAAQS) level of 35 $\mu g/m^3$ in all areas tested.

Ventilation

A heating, ventilating and air conditioning (HVAC) system has several functions. First it provides heating and, if equipped, cooling. Second, it is a source of fresh air. Finally, an HVAC system will dilute and remove normally occurring indoor environmental pollutants by not only introducing fresh air, but by filtering the airstream and ejecting stale air to the outdoors via exhaust ventilation. Even if an HVAC system is operating as designed, point sources of respiratory irritation may exist and cause symptoms in sensitive individuals. The following analysis examines and identifies components of the HVAC system and likely sources of respiratory irritant/allergen exposure due to water damage, aerosolized dust and/or chemicals found in the indoor environment.

Fresh air is provided by air handling units (AHUs) located on the roof. Fresh air is drawn into the AHUs via vents outside of the building. Air from the AHUs is filtered, heated/cooled and delivered to rooms via ducted supply vents. Stale air is drawn into ceiling-mounted return vents and returned to the AHUs.

It is recommended that HVAC systems be re-balanced every five years to ensure adequate air systems function (SMACNA, 1994). It was unknown when the last time these systems had been balanced.

Microbial/Moisture Concerns

BEH staff did not note any visible mold or musty odors during this visit. It is important to note the age and configuration of the building. As originally constructed, it is highly likely:

- The building was not originally designed with an HVAC system that provided chilled air
- The building foundation does not have insulation or a vapor barrier beneath the floor or foundation walls.

Without insulation beneath the floor, it is likely that it has a similar temperature as the soil beneath the foundation. In order to assess whether the floor was insulated, IAQ staff measured floor temperatures using a laser thermometer throughout the space to ascertain if the floor serves as a thermal bridge, which could result in the floor being prone to collecting condensation during hot, humid weather. Floor temperatures ranged from 54°F to 66°F, which were all below the measured air temperature throughout the space (Table 2). These measurements indicate the floor is colder by a range of 7-14°F below the air temperature. These measurements also indicate that the floors may be prone to condensation in hot, humid weather when the HVAC system is operating in chilling mode. A method to locate areas in a building prone to condensation would be to measure air and building material temperatures. If a wide temperature range exists between measurements, the building materials at the colder end of the range may be prone to becoming moistened with condensation in hot, humid weather, particularly when the HVAC system is chilling air. This phenomenon was likely exacerbated during the weather conditions experienced in New England during the summer of 2018:

> The New England area experienced an unprecedented period of extended hot, humid weather. According to the Washington Post, "[d]ata…show[s]…cities in the Northeast have witnessed such humidity levels for record-challenging duration...[i]ncluding Albany, Boston, Burlington Portland and Providence"

during the summer of 2018 (WP, 2018). "Boston and nearby locations… [saw]…historic numbers of those warm nights with low temperatures at or above 70 degrees…Providence and Blue Hill Observatory have already broken their annual records" (WP, 2018).

The key to managing condensation is understanding dew point. Condensation is the collection of moisture on a surface at or below the dew point. The dew point is the temperature that air must reach for saturation to occur. If a building material/component has a temperature below the dew point, condensation will accumulate on that material. Over time, condensation can collect and form water droplets. With a floor chilled through contact with soil/rock, and the infiltration of unconditioned hot, humid air during the warmer months, condensation on the floor is likely.

In addition, the presence of high relative humidity (>70%) alone for a significantly long period, can also cause water damage to susceptible materials. If these materials are porous, carbon-containing items (e.g., gypsum wallboard, carpeting, cloth, paper, and cardboard), mold can grow (ASHRAE, 1989).

It is recommended that porous material be dried with fans and heating within 24 to 48 hours of becoming wet (US EPA, 2008, ACGIH, 1989). If porous materials are not dried within this time frame, mold growth may occur. Water-damaged porous materials cannot be adequately cleaned to remove mold growth.

The basement level of the building contains a significant amount of materials that can support mold growth if exposed to moisture. In addition, a number of conditions exist that may increase relative humidity/moisture conditions in the basement, including the poor condition of the ventilation system. It is highly recommended that materials that can support mold growth be removed. Porous materials such as paper, cardboard, cloth and leather can all become mold-colonized if repeatedly exposed to moisture.

These types of conditions conducive to mold growth may result in an indoor environment that could adversely affect the health of occupants with respiratory disease such as asthma.

Other Conditions

Several other conditions were noted during the assessment, which can affect indoor air quality. Carpeting on the basement floor is likely past its service life. Aging carpet can produce fibers that can be irritating to the respiratory system. In addition, tears or lifting carpet can create tripping hazards. Carpeting should be cleaned annually or semi-annually in soiled high traffic areas as per the recommendations of the Institute of Inspection, Cleaning, and Restoration Certification (IICRC, 2012).

Also of note was the amount of materials stored in some areas. In both offices and cubicle areas, items were seen piled on windowsills, tabletops, counters, bookcases and desks. The large amount of items stored provides a means for dusts, dirt and other potential respiratory irritants to accumulate. These stored items, (e.g., papers, folders, boxes, etc.) also make it difficult for custodial staff to clean. Dust can be irritating to the eyes, nose and respiratory tract.

Conclusions/Recommendations

In view of the findings at the time of the assessment, the following recommendations are made:

1. Implement corrective actions recommended in previous IAQ assessments, if not already implemented (see Appendix A).
2. Ensure that chilled water HVAC system pipes are properly insulated to prevent condensation.
3. Consideration should be given to replacing carpeting in the basement level. Consider removing water-damaged, musty, or worn carpeting. Replace with non-porous materials if possible. Before removal, please assess whether carpeting is adhered to asbestos-containing floor tile. If so, please remove carpet in a manner consistent with Massachusetts Asbestos laws and regulations.
4. For buildings in New England, periods of low relative humidity during the winter are often unavoidable. Therefore, scrupulous cleaning practices should be adopted to minimize common indoor air contaminants whose irritant effects can be enhanced when the relative humidity is low. To control for dusts, a HEPA filter equipped

vacuum cleaner in conjunction with wet wiping of all surfaces is recommended. Drinking water during the day can help ease some symptoms associated with a dry environment (throat and sinus irritations).

5. In addition to the building's existing HVAC system, consider operating dehumidifiers during hot, humid weather to reduce relative humidity in basement areas. Ensure all dehumidifiers are emptied, cleaned and maintained regularly to prevent spills and odors.
6. Avoid storing porous materials on floors, particularly in the lower level. Examine existing materials for water damage and odors and replace as needed.
7. Keep stored items organized and move periodically to remove dust and debris.
8. Clean remaining carpeting annually or semi-annually in soiled high traffic areas as per the recommendations of the Institute of Inspection, Cleaning and Restoration Certification (IICRC 2012).
9. For more information on mold refer to "Mold Remediation in Schools and Commercial Buildings" published by the US Environmental Protection Agency (US EPA, 2008). http://www.epa.gov/mold/mold-remediation-schools-and-commercial-buildings-guide.
10. Refer to resource manual and other related IAQ documents located on the MDPH's website for further building-wide evaluations and advice on maintaining public buildings. These documents are available at: http://mass.gov/dph/iaq.

References

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